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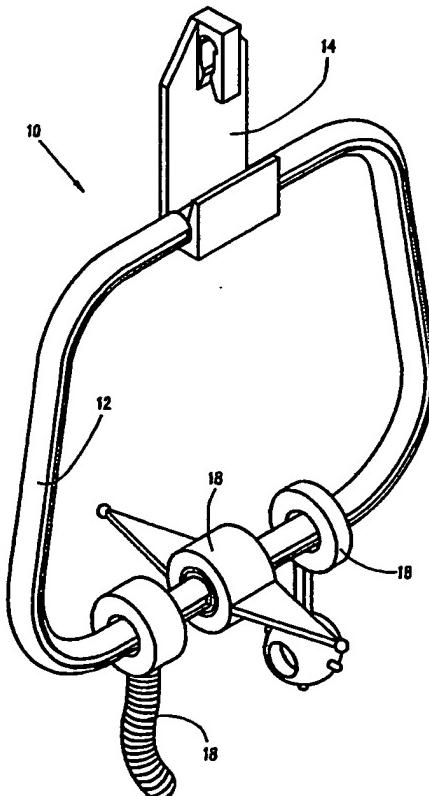
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(54) Title: IMPROVED CHICKEN TOY

(57) Abstract

A farm animal toy (10) including a colored structure (12, 18) suitable for stimulating at least one farm animal characterized in that the color of the colored structure is selected so as to significantly improve at least one measure of the output of at least one farm animal.



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- 1 -

IMPROVED CHICKEN TOY  
FIELD OF THE INVENTION

The present invention relates generally to toys for farm animals.

5           BACKGROUND OF THE INVENTION

Farm animals are normally kept in relatively crowded living quarters. Often, little environmental stimulation is provided. Recently, more has become known about behavioral requirements 10 of farm animals as opposed to physiological requirements about which much is known.

Layer chickens are typically quartered in cages, 2 to 10 birds per cage. The birds are known to peck at one another. Although some of the 15 pecking is harmless, some of the pecking causes physical damage and may even be fatal to the pecked bird. Normally, a hierarchy develops between the birds whereby the birds which are high within the hierarchy peck birds lower within the hierarchy. 20 The birds lowest in the hierarchy are most frequently pecked and the relatively low laying rate of these low-status birds is related to the stress they undergo due to being frequently pecked.

Toys for layer chickens are known which 25 are intended to attract pecking birds, thereby diverting attention from the lower status birds and reducing the rate of pecking at the lower status birds. The toys are also believed to be beneficial over and above the consideration of preventing

- 2 -

pecking because of the general principle that environmental stimulation is advantageous for creatures having at least some intelligence.

The results of exposure to peckable toys  
5 are discussed generally in United States Patent  
5,010,851 to Gvaryahu et al.

Recent experiments have demonstrated that environmental stimulation is successful in reducing the aggression level of birds in a cage, in  
10 increasing the total mass of eggs laid to a statistically significant extent, and in decreasing bird mortality to a statistically significant extent. These experiments are reported in the following reports:

15 "Environmental Enrichment in Laying Hens", G. Gvaryahu et al, Proc of The World's Poultry Science Association, Israel Branch, The XXVI-th Annual Convention, p. 66, Zichron Yaakov, Israel, 1988;

20 "Environment Enrichment and Contact Lenses in Laying Hens", E. Grossman et al, Proc of The World's Poultry Science Association, Israel Branch, The XXVII-th Annual Convention, p. 68, Zichron Yaakov, Israel, 1989; and

25 "The Effect of Environmental Enrichment on Egg-Layers - Final Results of Six Experiments", G. Gvaryahu et al, Proc of The World's Poultry Science Association, Israel Branch, The XXVIII-th Annual Convention, p. 75, Zichron Yaakov, Israel,

30 1990.

Agro Top Ltd., P. O. B. 2268, Rehovot 76120, presently markets AGROTOY, a pecking toy which is suspended in layer cages.

Domestic chickens (*Gallus-domesticus*)  
35 have been found to prefer the purple and orange portions of the spectrum, approximately 380-480 nm and 595-625 nm, respectively, in certain contexts,

- 3 -

as reported in detail in the following two publications:

Fischer, J. F., 1975. "The behavior of chickens", The Behavior of Domestic Animals, E. S.

5 E. Hafez (Ed.), Bailliere, Tindall and Cox, London, UK, pp. 454-489;

Hess, E. H., 1956. "Natural preferences of chicks and ducklings", Psychol. Rep., 2, 477-483;

10 Ducks have also been found, in certain contexts, to prefer blue and red to other colors, as reported in Hess, E. H., 1959, "Imprinting", Science, NY, 130, 133-141.

SUMMARY OF THE INVENTION

15 The present invention seeks to provide an improved toy for farm animals.

There is thus provided in accordance with a preferred embodiment of the present invention a farm animal toy including a colored structure

20 suitable for stimulating at least one farm animal characterized in that the color of the colored structure is selected so as to significantly improve at least one measure of the output of at least one farm animal.

25 Further in accordance with a preferred embodiment of the present invention, the farm animal is a layer and the at least one measure of the output of the farm animal comprises at least one of the following group: egg weight; egg mass  
30 (number of eggs x egg weight); life expectancy; and number of eggs laid.

Still further in accordance with a preferred embodiment of the present invention, the color of the colored structure is selected from among colors well perceived by the farm animal.

35 Additionally in accordance with a preferred embodiment of the present invention, a

- 4 -

substantial portion of the colored structure is blue.

Further in accordance with a preferred embodiment of the present invention, the frame of  
5 the colored structure is blue.

Still further in accordance with a preferred embodiment of the present invention, the color of at least one portion of the colored structure is red.

10 Additionally in accordance with a preferred embodiment of the present invention, the color of at least one portion of the colored structure is white.

BRIEF DESCRIPTION OF THE DRAWINGS

15 The present invention will be understood and appreciated from the following detailed description, taken in conjunction with the drawings in which:

Figs. 1 and 2 are pictorial illustrations  
20 of peckable toys;

Figs. 3A and 3B are conceptual illustrations of color combinations for peckable toys characterized in that the color combination of Fig. 3A is preferable over the color combination of  
25 Fig. 3B;

Figs. 4A and 4B are conceptual illustrations of color combinations for peckable toys characterized in that the color combination of Fig. 4A is preferable over the color combination of  
30 Fig. 4B;

Figs. 5A and 5B are conceptual illustrations of color combinations for peckable toys characterized in that the color combination of Fig. 5A is preferable over the color combination of  
35 Fig. 5B;

Figs. 6A and 6B are conceptual illustrations of color combinations for peckable

- 5 -

toys characterized in that the color combination of Fig. 6A is preferable over the color combination of Fig. 6B;

Figs. 7A and 7B are conceptual

- 5 illustrations of color combinations for peckable toys characterized in that the color combination of Fig. 7A is preferable over the color combination of Fig. 7B;

Figs. 8A and 8B are conceptual

- 10 illustrations of color combinations for peckable toys characterized in that the color combination of Fig. 8A is preferable over the color combination of Fig. 8B; and

Figs. 9A and 9B are conceptual

- 15 illustrations of color combinations for peckable toys characterized in that the color combination of Fig. 9B is preferable over the color combination of Fig. 9A.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

- 20 Recent experiments reported herein indicate that a preferred color for peckable chicken toys is blue. According to a preferred embodiment, a substantial portion of the chicken toy is blue. Further in accordance with a 25 preferred embodiment of the present invention, the remaining portions of the peckable toy are blue and/or red.

- Reference is made to Fig. 1 which is a pictorial illustration of a configuration for 30 a peckable toy similar to the configuration of the peckable toy marketed by Agro Top Ltd. As shown, the peckable toy 10 comprises a frame portion 12 suspended from a hanging portion 14 which may be hung on a suitable support within the 35 chicken cage such as a bar. The peckable toy 10 also comprises at least one moving part 18, which is preferably pivotably mounted on the frame 12.

- 6 -

The birds peck at the moving parts 18, which may have any suitable shape so as to arouse the birds' interest. The various parts of the toy 10 may be formed of any suitable material such as

- 5 polypropylene.

According to a preferred embodiment of the present invention, the frame 12 is blue.

- Preferably, at least one moving part from among the moving parts 18, and preferably all of the moving  
10 parts 18, are either blue or red or a combination thereof.

Reference is now made to Fig. 2 which is a pictorial illustration of another configuration for a peckable toy. As shown, the peckable toy 30 comprises a frame portion 32 which may be hung on a suitable support within a chicken cage. The peckable toy 30 also comprises at least one moving part 34. Each moving part 34 may comprise a colored bead 36 fixedly mounted on a bead support portion 38 including a loop 40 which is operative to allow relatively free motion of the moving part 34 relative to the frame 32. The various parts of the toy 10 may be formed of any suitable material. For example, all parts of the toy may be formed of  
15 a suitable metal apart from the colored bead, which may be formed of a suitable plastic.  
20  
25

It is appreciated that the peckable toy configurations illustrated in Figs. 1 and 2 are merely exemplary of possible configurations. Any  
30 configuration which includes a movable part which may be arranged so as to be accessible for pecking, such that the movable part reacts to being pecked, is suitable.

Recent experiments have given the  
35 following results regarding the relative effectiveness of peckable toys of various colors:

- 7 -

Experiment 1: 6 Leghorn layers housed one per cage in 30 cm x 45 cm cages were exposed to toys such as the toy illustrated in Fig. 2. Three identical sequences of experimental conditions were provided. Each sequence included 6 observations, spaced 1-2 days apart. In the first observation, the 6 Leghorn layers, referenced herein layers 1-6, were exposed to blue, red, white, green, yellow and pink toys, respectively for a one-hour period. In the second observation, 1-2 days later, the 6 layers 1-6 were respectively exposed to red, white, green, yellow, pink and blue toys, for a one-hour period. Observations 3-6 were designed similarly. For example, in observation 6, layers 1-6 were respectively exposed to pink, blue, red, white, green and yellow toys, for a one-hour period.

In each of the 18 observations, the total number of pecks at the toy for each of the six layers was recorded. The 6 colors were then ranked by pecking preference. For example, a color was ranked 1 if it was pecked more than the other 5 colors.

The color preferences for each of the layers and the mean color preference over layers, where 1 indicates the highest level of preference and 6 indicates the lowest level of preference, were as follows:

Table 1:

LAYER	GREEN	BLUE	RED	WHITE	YELLOW	PINK
1	6	2.5	2.5	1	4.5	4.5
2	6	1	4	2	5	3
3	2	4	6	3	1	5
4	5	1	2.5	2.5	6	4
5	4.5	2.5	1	2.5	4.5	6
6	5	1	3	2	4	6
<hr/>						
MEAN	4.75	2	3.17	2.16	4.17	4.75

- 8 -

A one-way ANOVA performed on the mean color preferences indicated that blue and white toys were more preferred than green, yellow or pink toys, to a statistically significant extent.

- 5        Red toys were less preferred than blue or white toys, but not to a statistically significant extent, and were more preferred than green, yellow or pink toys, but not to a statistically significant extent.
- 10      Experiment 2:     6 Leghorn layers housed one per cage in 30 cm x 45 cm cages were exposed to toys such as the toy illustrated in Fig. 2, except that 4 moving parts were used instead of 3. Three identical sequences of experimental conditions were
- 15      provided. Each sequence included 3 observations. In the first observation, the 6 Leghorn layers, referenced herein layers 1-6, were exposed to red, white, red/white, red, white, and red/white toys, respectively, for a one-hour period. In the red
- 20      toys and the white toys, all beads were, respectively, red and white. In the red/white toys, two of the beads were red and two of the beads were white. In the second observation, layers 1-6 were respectively exposed to white, red/white, red, white, red/white and red toys,
- 25      respectively, for a one-hour period. In the third observation, layers 1-6 were respectively exposed to red/white, red, white, red/white, red and white toys, respectively, for a one-hour period. The
- 30      total number of pecks for each one-hour period were recorded. When red/white toys were used, the total number of pecks were recorded separately for white and red beads. The total number of pecks data was employed to rank the color preferences of the
- 35      layers.

The color preferences for each of the layers and the mean color preference over layers,

- 9 -

where 1 indicates the highest level of preference and 3 indicates the lowest level of preference, were as follows:

Table 2:

5	LAYER	WHITE	RED/WHITE	RED
	1	1	2	3
	2	1	3	2
	3	1	2	3
	4	3	1	2
10	5	2	1	3
	6	2.5	1	2.5
<hr/>				
	MEAN	1.75	1.66	2.58

The above results indicate that red and  
15 white toys enjoyed a higher level of preference than did white toys, and white toys enjoyed a higher level of preference than did red toys.

Experiment 3: Experiment 3 was identical to Experiment 2 except that blue toys were used  
20 instead of red toys and green toys were used instead of white toys. Red/white toys were also used, as in Experiment 2.

The color preferences for each of the layers and the mean color preference over layers,  
25 where 1 indicates the highest level of preference and 3 indicates the lowest level of preference, were as follows:

Table 3:

	LAYER	BLUE	RED/WHITE	GREEN
30	1	2	1	3
	2	1	2	3
	3	3	2	1
	4	1	3	2
	5	1	2.5	2.5
35	6	2.5	1	2.5
<hr/>				
	MEAN	1.75	1.91	2.33

- 10 -

The above results indicate that blue toys enjoyed a higher level of preference than did red/white toys, and red/white toys enjoyed a higher level of preference than did green toys.

5     Experiment 4:     PBU-Yarkon layers at the end of their second laying period were exposed to peckable toys similar to the peckable toy illustrated in Fig. 1. The peckable toys were either white or colored. 50 of the colored toys had blue frames,

10    red hanging portions, and 3 moving parts which were red, blue and green, respectively. The remaining 27 colored toys had red frames, blue hangers, and 3 moving parts which were red, blue and green, respectively.

15    The layers were housed in 30 cm x 45 cm cages, 2 birds per cage. 77 cages were assigned to a control group and were not exposed to toys. 77 cages were exposed to colored toys. 70 cages were exposed to white toys. Each 7 cages corresponds to 20 a unit of observation within which mean daily egg count and mean egg weight were computed. In other words, each 14 birds formed a unit of observation and there were 11, 11 and 10 units of observation in the control, colored and white experimental 25 groups, respectively. In total, there were 32 units of observation.

The experiment took place over a period of one month. The results of the experiment were as follows:

30    Table 4:

EXPERIMENTAL GROUP	MEAN DAILY EGG COUNT	MEAN EGG WEIGHT (GR)	MEAN DAILY FOOD CONSUMED (GR)
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Control	5.62	70.55	114.88
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Colored	5.91	73.34	114.21
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35    White	5.79	71.88	114.09
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Raw data corresponding to the Mean Daily

- 11 -

Egg Count column of Table 4 is appended hereto and is referenced Appendix A.

Raw data corresponding to the Mean Egg Weight column of Table 4 is appended hereto and is 5 referenced Appendix B.

Raw data corresponding to the Mean Daily Food Consumed column of Table 4 is appended hereto and is referenced Appendix C.

Table 4 shows that layers exposed to 10 colored toys laid more eggs per day and their mean egg weight was greater to a statistically significant extent, but they did not require more food. An ANOVA table showing the statistical significance of the results is appended hereto and 15 referenced Appendix H. In Appendix H, group 1 is the Control group, group 2 is the White group and group 3 is the Colored group.

Experiment 5: PBU-Yarkon layers at the end of their second laying period were exposed to peckable 20 toys similar to the peckable toy illustrated in Fig. 1. A first experimental group of 35 cages was exposed to peckable toys with blue frames, blue hanging portions and 3 moving parts which were respectively red, green and blue. A second 25 experimental group of 35 cages was exposed to peckable toys with red frames, red hanging portions and moving parts which were respectively red, green and blue. A first control group of 70 cages was exposed to white peckable toys. A second control 30 group of 77 cages was not exposed to any toys. Each 7 cages was a unit of observation within which mean daily egg count and mean egg weight were computed. Therefore, there were 5, 5, 10 and 11 units of observations in the first and second 35 experimental groups and in the first and second control groups, respectively, or a total of 33 units of observation.

- 12 -

The layers were housed in 30 cm x 45 cm cages, 2 birds per cage. The experiment took place over a period of 18 days. The results of the experiment were as follows:

5 Table 5:

	EXPERIMENTAL GROUP	MEAN DAILY EGG COUNT	MEAN EGG WEIGHT (GR)	MEAN EGG MASS (GR)	MEAN DAILY FOOD CONSUMED (GR)
10	Blue Frame	5.89	74.05	436.2	105.47
	Red Frame	5.26	70.26	369.6	109.78
	White	5.74	69.85	400.9	107.35
	No toy	4.97	70.1	348.4	107.02

Raw data corresponding to the Mean Daily Egg Count column of Table 5 is appended hereto and is referenced Appendix D.

Raw data corresponding to the Mean Daily Food Consumed column of Table 5 is appended hereto and is referenced Appendix E.

Raw data corresponding to the Mean Egg Weight column of Table 5 is appended hereto and is referenced Appendix F.

Table 5 shows that layers exposed to blue framed toys having blue hanging portions and red, blue and green moving parts laid more eggs per day and their mean egg weight was greater, to a statistically significant extent, as shown in the ANOVA table appended hereto and referenced Appendix G. In Appendix G, group 1 is the Blue group, group 2 is the Red group, group 3 is the White group and group 4 is the No Toy group.

Experiment 6: Lohman layers in their first laying period were exposed to peckable toys similar to the peckable toy illustrated in Fig. 1. A first experimental group of 20 cages was exposed to peckable toys with blue frames, two red moving parts and one blue moving part between the two red

- 13 -

- moving parts. A second experimental group of 20 cages was exposed to peckable toys with blue frames and three moving parts which were red, blue and green, respectively. A control group of 40 cages 5 was not exposed to any toys. Each 10 cages corresponds to a unit of observation within which mean daily egg count and mean egg weight were computed.

The layers were housed in 30 cm x 45 cm 10 cages, 3 birds per cage. The experiment took place over a period of 36 days. The results of the experiment were as follows:

Table 6:

	EXPERIMENTAL GROUP	MEAN DAILY EGG COUNT	MEAN EGG WEIGHT (GR)	MEAN EGG MASS (GR)
15	Blue 1	28.53	64.61	1843
	Blue 2	27.63	64.29	1785
	No toy	27.49	64.62	1776

The above table shows that layers exposed 20 to blue framed toys having 2 red and one blue moving part laid more eggs per day and their mean egg mass was greater, relative to the layers in the other experimental groups.

Experiment 7: An experimental group of Lohman 25 layers in the beginning of their second laying period were exposed to peckable toys and were compared to a control group of Lohman layers in the beginning of their second laying period which were not exposed to peckable toys, to investigate 30 differences in layer mortality. Each group included 21 observations. Each observation was conducted as follows:

A plurality of layers, such as 10 - 18 35 layers, were housed 3 per cage in 30 cm x 45 cm cages. Depending on the experimental condition, the cages were or were not provided with a peckable toy. The duration of the experiment was from 13

- 14 -

November 1990 to 29 July 1991. The colors of the peckable toy were as follows: blue frame, 3 moving parts which were red, blue and red, and a red hanging portion, as illustrated in Fig. 4A.

5       The results of Experiment 7 are summarized in Appendix I. In the raw data table, for each of the  $21 \times 2 = 42$  observations, percent mortality appears in column 1, the experimental condition appears in column 2, the number of layers 10 as the experiment began appears in column 3 and the number of surviving layers at termination of the experiment appears in column 4.

15      The ANOVA table shows that mortality was significantly increased in the experimental group which was provided with peckable toys, relative to the control group which was not so provided.

20      It is believed that the performance of layers exposed to a completely blue toy results is slightly less good than the performance of layers exposed to a toy with a blue frame, a red hanging portion, 2 red moving parts and one blue moving part.

25      It is believed that a preferred combination of colors for a peckable toy is as follows: A substantial portion of the toy, such as the frame, is blue. Other portions of the toy such as the hanging portion and moving parts, may be other than blue. Preferably, approximately half of the hanging portion and moving parts is blue and 30 the remaining half is either red, blue or white. One particularly suitable combination is: blue frame, red hanging portion, two red moving parts, one blue moving part.

35      Figs. 3A-9B are conceptual illustrations of color combinations for peckable toys characterized in that the color combination of Figs. 3A, 4A, 5A, 6A, 7A, 8A and 9B are believed to

- 15 -

be preferable in improving the output of layers, relative to the color combinations of Figs. 3B, 4B, 5B, 6B, 7B, 8B and 9A respectively. It is appreciated that the color combinations of Figs.

5 3A, 4A, 5A, 6A, 7A, 8A and 9B may be used for any suitable configuration of peckable toy. It is also appreciated that the particular toys illustrated in Figs. 3A, 4A, 5A, 6A, 7A, 8A and 9B are merely illustrative of the preferred pecking toys

10 described herein.

It is believed that the differences in layers' pecking behavior, laying performance and well-being when exposed to pecking toys of different colors is related in differences in the  
15 birds' capability to perceive different colors.

- 16 -

APPENDIX A

UNIT	TYPE	/UNIT NO.	24/02	25/02	26/02	27/02	28/02	01/03	02/03	DATE
CONTROL	1		6	7	7	6	7	6	4	
WHITE	2		5	6	7	3	5	7	4	
COLORED	3		5	8	4	6	4	4	6	
CONTROL	4		6	7	4	4	4	5	3	
WHITE	5		5	5	3	3	2	5	7	
COLORED	6		7	4	3	5	4	6	5	
CONTROL	7		7	5	5	3	9	5	5	
WHITE	8		3	5	1	8	5	4	3	
COLORED	9		2	4	3	6	3	4	4	
CONTROL	10		5	4	4	6	2	4	4	
WHITE	11		9	8	4	5	6	6	6	
COLORED	12		2	5	1	4	4	5	4	
CONTROL	13		5	7	4	7	6	5	5	
WHITE	14		6	6	4	5	6	5	6	
COLORED	15		3	6	4	5	5	6	7	
CONTROL	16		5	4	5	5	2	3	4	
COLORED	17		8	7	9	6	4	6	8	
COLORED	18		7	5	7	6	7	7	7	
COLORED	19		4	8	3	8	3	5	8	
CONTROL	20		9	7	6	4	5	5	8	
WHITE	21		5	7	9	7	2	6	5	
WHITE	22		6	7	5	2	4	4	3	
CONTROL	23		5	5	5	6	5	7	7	
COLORED	24		7	8	8	5	5	7	10	
WHITE	25		3	8	8	9	6	8	5	
CONTROL	26		5	8	7	6	6	4	6	
COLORED	27		7	7	9	6	12	2	9	
WHITE	28		5	7	10	9	5	3	5	
CONTROL	29		6	6	5	5	4	7	5	
COLORED	30		5	7	3	6	5	6	5	
WHITE	31		7	6	6	7	5	6	5	
CONTROL	32		11	6	7	9	7	6	11	
CONTROL TOTAL			70	66	59	61	57	53	60	
WHITE TOTAL			54	65	57	58	46	53	56	
COLORED TOTAL			57	69	54	63	55	63	68	
CONTROL MEAN			6.36	6.00	5.36	5.55	5.18	4.82	5.45	
WHITE MEAN			5.40	6.50	5.70	5.80	4.60	5.30	5.60	
COLORED MEAN			5.18	6.27	4.91	5.73	5.00	5.73	6.18	

SUBSTITUTE SHEET

- 17 -

UNIT TYPE	/UNIT NO.	03/03	04/03	05/03	06/03	07/03	08/03	09/03	DATE
CONTROL	1	9	6	6	7	5	6	8	
WHITE	2	6	5	4	7	6	4	3	
COLORED	3	7	4	7	8	6	4	6	
CONTROL	4	5	6	7	4	10	3	6	
WHITE	5	2	3	4	5	5	4	3	
COLORED	6	4	5	4	5	7	7	5	
CONTROL	7	5	3	5	4	6	4	8	
WHITE	8	7	5	3	5	5	3	5	
COLORED	9	6	4	4	5	5	5	4	
CONTROL	10	5	4	3	5	3	5	6	
WHITE	11	9	4	7	8	7	7	5	
COLORED	12	5	4	5	3	4	2	6	
CONTROL	13	7	8	2	6	8	6	8	
WHITE	14	4	4	8	6	3	7	5	
COLORED	15	6	6	8	8	7	4	8	
CONTROL	16	5	3	5	6	6	3	4	
COLORED	17	6	8	4	8	7	4	11	
COLORED	18	6	7	5	5	4	7	7	
COLORED	19	8	5	5	8	7	6	6	
CONTROL	20	5	7	3	6	7	5	6	
WHITE	21	8	6	5	6	6	3	7	
WHITE	22	6	3	6	5	5	3	6	
CONTROL	23	4	6	4	4	5	4	5	
COLORED	24	8	6	7	8	7	7	5	
WHITE	25	11	8	8	8	10	7	8	
CONTROL	26	6	5	5	6	9	6	5	
COLORED	27	8	7	7	8	5	8	6	
WHITE	28	9	6	9	9	7	8	6	
CONTROL	29	7	8	5	6	4	8	4	
COLORED	30	7	3	7	5	5	6	5	
WHITE	31	7	8	9	6	8	7	7	
CONTROL	32	7	3	7	12	7	9	8	
CONTROL TOTAL		65	59	52	66	70	59	68	
WHITE TOTAL		69	52	63	65	62	53	55	
COLORED TOTAL		71	59	63	71	64	60	69	
CONTROL MEAN		5.91	5.36	4.73	6.00	6.36	5.36	6.18	
WHITE MEAN		6.90	5.20	6.30	6.50	6.20	5.30	5.50	
COLORED MEAN		6.45	5.36	5.73	6.45	5.82	5.45	6.27	

SUBSTITUTE SHEET

- 18 -

UNIT	TYPE	/UNIT NO.	10/03	11/03	12/03	13/03	14/03	15/03	16/03	DATE
CONTROL		1		4	8	8	6	6	6	7
WHITE		2		7	6	4	5	5	6	7
COLORED		3		5	8	5	4	6	8	6
CONTROL		4		4	6	5	4	5	5	8
WHITE		5		3	3	4	3	4	2	3
COLORED		6		6	7	3	6	7	5	4
CONTROL		7		7	3	7	4	3	5	3
WHITE		8		4	5	6	5	6	4	4
COLORED		9		6	4	7	5	3	5	4
CONTROL		10		5	4	3	7	6	9	3
WHITE		11		9	7	6	7	3	3	2
COLORED		12		4	4	4	4	3	5	5
CONTROL		13		7	5	6	6	8	5	5
WHITE		14		6	9	5	6	8	5	8
COLORED		15		8	7	7	5	7	6	7
CONTROL		16		5	5	6	4	4	6	8
COLORED		17		8	8	4	10	8	10	4
COLORED		18		4	7	8	8	8	10	4
COLORED		19		6	6	8	5	8	5	7
CONTROL		20		5	6	8	4	6	5	6
WHITE		21		5	5	3	8	6	5	5
WHITE		22		5	5	5	6	5	6	5
CONTROL		23		6	6	7	5	3	3	4
COLORED		24		8	9	5	8	9	4	5
WHITE		25		8	10	9	9	4	8	6
CONTROL		26		5	8	7	6	8	5	6
COLORED		27		7	7	6	8	6	4	9
WHITE		28		7	7	11	8	8	8	10
CONTROL		29		8	5	6	4	4	4	4
COLORED		30		7	7	7	5	7	5	6
WHITE		31		8	5	9	7	5	7	8
CONTROL		32		8	12	2	10	7	11	6
CONTROL TOTAL			64	68	65	60	57	60	60	60
WHITE TOTAL			62	62	62	64	56	62	55	55
COLORED TOTAL			69	74	64	68	75	64	63	63
CONTROL MEAN			5.82	6.18	5.91	5.45	5.18	5.45	5.45	5.45
WHITE MEAN			6.20	6.20	6.20	6.40	5.60	6.20	5.50	5.50
COLORED MEAN			6.27	6.73	5.82	6.18	6.82	5.82	5.73	

- 19 -

		SUMMARY									
GROUP	TYPE/ GROUP NO.	17/03	18/03	19/03	20/03	21/03	22/03	23/03	24/03		
CONTROL	1	4	6	8	6	7	6	6	5	5	45.07%
WHITE	2	5	7	8	6	6	6	6	4	4	37.93%
COLORED	3	4	6	4	4	5	5	5	4	4	39.41%
CONTROL	4	5	4	7	4	5	4	4	7	7	38.92%
WHITE	5	2	3	4	4	5	3	3	3	3	25.37%
COLORED	6	9	6	5	5	5	6	5	5	5	39.16%
CONTROL	7	5	5	3	1	3	5	4	5	5	35.71%
WHITE	8	2	2	6	6	3	8	3	5	5	31.28%
COLORED	9	5	5	5	3	5	7	4	4	4	32.02%
CONTROL	10	2	2	5	5	3	7	6	6	3	30.30%
WHITE	11	6	3	7	3	5	7	6	8	7	48.03%
COLORED	12	3	8	7	7	4	8	5	6	7	25.86%
CONTROL	13	8	5	5	5	5	7	7	6	6	43.35%
WHITE	14	5	7	8	6	6	6	4	4	4	41.63%
COLORED	15	7	6	4	4	6	7	5	5	5	44.83%
CONTROL	16	3	3	6	4	4	7	5	7	7	33.50%
COLORED	17	8	8	6	6	5	8	8	6	7	50.49%
COLORED	18	9	4	7	8	5	9	6	9	10	49.75%
COLORED	19	4	8	8	7	8	8	5	6	6	44.33%
CONTROL	20										44.33%

- 20 -

LAYING TABLE (continued)

GROUP	TYPE / GROUP NO.	17/03	18/03	19/03	20/03	21/03	22/03	23/03	24/03	SUMMARY
WHITE	21	8	5	3	4	6	7	5	5	39.90%
WHITE	22	5	4	5	4	4	2	4	6	34.24%
CONTROL	23	3	6	3	8	6	7	3	5	34.24%
COLORED	24	5	8	6	6	7	6	5	6	47.29%
WHITE	25	8	8	8	6	7	7	8	6	54.93%
CONTROL	26	4	7	6	6	4	7	6	5	43.60%
COLORED	27	8	8	5	6	7	6	7	6	49.26%
WHITE	28	7	9	6	6	7	5	6	8	52.46%
CONTROL	29	5	9	9	3	4	2	5	5	37.93%
COLORED	30	6	6	7	5	8	7	7	5	41.87%
WHITE	31	6	8	7	4	7	7	7	5	47.78%
CONTROL	32	7	9	8	9	5	6	5	6	54.43%
TOTAL CONTROL	53	72	66	66	56	59	62	59	61.79	
TOTAL WHITE	57	62	62	46	51	57	60	53	57.90	
TOTAL COLORED	68	69	60	64	68	67	65	61	65.00	
CONTROL MEAN	4.82	6.55	6.00	6.00	5.09	5.36	5.64	5.36	5.62	
WHITE MEAN	5.70	6.20	6.20	4.60	5.10	5.70	6.00	5.30	5.79	
COLORED MEAN	6.18	6.27	5.45	5.82	6.18	6.09	5.91	5.55	5.91	

- 21 -

## APPENDIX B

UNIT TYPE /	UNIT NO.	24/02	27/02	03/03	06/03	10/03	13/03	17/03	20/03	24/03	DATE
CONTROL	1	375	450	650	475	300	450	300	475	300	375
WHITE	2	325	250	475	500	525	350	375	200	300	300
COLORED	3	375	400	525	575	400	325	300	300	300	275
CONTROL	4	400	275	300	275	300	300	350	275	500	500
WHITE	5	385	225	150	350	225	225	325	300	225	225
COLORED	6	450	365	275	375	450	450	625	500	375	375
CONTROL	7	475	215	300	250	450	275	275	275	350	325
WHITE	8	250	550	475	350	275	400	150	200	200	325
COLORED	9	135	400	425	425	425	375	375	400	400	325
CONTROL	10	350	425	375	375	350	500	150	350	215	215
WHITE	11	650	350	650	575	650	450	425	500	500	500
COLORED	12	150	250	350	225	325	300	200	300	300	175
CONTROL	13	315	475	525	450	500	500	575	575	425	425
WHITE	14	450	375	325	375	475	475	400	350	300	300
COLORED	15	215	350	500	575	625	400	500	450	375	375
CONTROL	16	375	400	350	475	400	275	225	275	275	525
COLORED	17	575	450	425	525	625	800	600	525	575	575
COLORED	18	500	400	425	350	325	525	625	475	725	725
COLORED	19	225	575	575	650	425	325	300	650	450	450
CONTROL	20	650	300	350	400	375	250	400	600	350	350

SUBSTITUTE SHEET

- 22 -

## APPENDIX B (continued)

UNIT	TYPE /	UNIT NO.	24/02	27/02	03/03	06/03	10/03	13/03	17/03	20/03	24/03	DATE
WHITE	21	375	500	550	425	275	575	550	550	300	300	38/5
WHITE	22	425	150	425	325	350	425	350	350	300	300	42/5
CONTROL	23	275	375	225	250	375	275	200	200	550	550	35/0
COLORED	24	475	300	625	550	550	575	575	325	450	450	45/0
WHITE	25	200	650	750	575	575	625	625	550	400	400	42/5
CONTROL	26	350	500	350	450	350	400	400	300	425	425	41/5
COLORED	27	475	500	575	600	475	600	550	550	450	450	47/5
WHITE	28	375	700	625	625	475	575	475	475	450	450	57/5
CONTROL	29	400	375	425	400	600	600	250	250	375	375	35/0
COLORED	30	300	450	500	375	575	400	400	500	475	475	37/5
WHITE	31	515	525	500	450	625	500	475	475	275	275	37/5
CONTROL	32	825	650	475	1000	525	750	500	500	650	650	45/0
CONTROL TOTAL		4790	4440	4325	4800	4525	4225	3650	4750	4280	4280	44/21
WHITE TOTAL		3950	4275	4925	4550	4450	4600	4075	3275	3835	3835	42/15
COLORED TOTAL		3875	4440	5200	5225	5200	5075	4900	4975	4575	4575	48/29
CONTROL MEAN		68.43	72.79	66.54	72.73	70.70	70.42	68.87	71.97	72.54	72.54	70.55
WHITE MEAN		73.15	73.71	71.38	70.00	71.77	71.88	71.49	71.20	72.36	72.36	71.88
COLORED MEAN		67.98	70.48	73.24	73.59	75.36	74.63	72.06	77.73	75.00	75.00	73.34

SUBSTITUTE SHEET

- 23 -

APPENDIX C

[09/03] MEAN DAILY FOOD CONSUMED

UNIT TYPE /	FOOD GIVEN /	FOOD REMAINING /	MEAN FOOD CONSUMED
CONTROL	21450	641	114.34
WHITE	21450	768	113.64
COLORED	21450	773	113.61

[23/03]

UNIT TYPE / FOOD GIVEN / FOOD REMAINING / MEAN DAILY FOOD CONSUMED

CONTROL	21450	443	115.42
WHITE	21450	605	114.53
COLORED	21450	555	114.81

SUBSTITUTE SHEET

- 24 -

## APPENDIX D

UNIT	TYPE / UNIT NO.	25/03	26/03	27/03	28/03	29/03	30/03	31/03	DATE
CONTROL	1	4	7	4	4	4	4	5	4
WHITE	2	7	3	8	6	6	5	2	5
RED	3	2	7	3	3	4	5	5	5
CONTROL	4	4	5	8	7	6	5	5	5
WHITE	5	5	4	4	3	5	3	4	4
BLUE	6	4	4	7	6	6	3	3	9
CONTROL	7	4	4	4	4	4	4	4	3
WHITE	8	3	5	5	7	2	6	5	5
BLUE	9	5	5	6	2	3	5	5	2
CONTROL	10	5	5	3	3	4	4	4	3
WHITE	11	6	4	4	6	7	7	7	7
RED	12	4	4	8	2	3	5	5	3
CONTROL	13	4	4	5	7	7	4	4	4
WHITE	14	5	5	9	9	3	5	5	8
BLUE	15	8	8	3	3	4	4	4	8
CONTROL	16	3	3	7	7	7	6	6	6
BLUE	17	10	6	7	7	7	6	6	6
RED	18	6	7	7	7	7	6	6	6
BLUE	19	7	6	7	7	5	4	6	8
CONTROL	20	6	6	6	6	6	6	6	8

SUBSTITUTE SHEET

- 25 -

**APPENDIX D**

DIVISION OF EGGS PER GROUP PER DAY (continued)									
UNIT	TYPE	UNIT NO.	25/03	26/03	27/03	28/03	29/03	30/03	31/03
WHITE	21		6	5	7	4	5	4	3
WHITE	22		2	5	6	6	6	6	7
CONTROL	23		5	5	3	3	4	3	3
BLUE	24		9	5	5	4	5	5	8
WHITE	25		7	5	8	7	6	8	8
CONTROL	26		5	5	6	3	5	5	7
RED	27		6	4	8	6	6	7	5
WHITE	28		8	5	4	7	6	8	5
CONTROL	29		4	4	6	5	5	7	5
RED	30		6	6	4	3	5	3	5
WHITE	31		5	8	6	8	7	6	6
CONTROL	32		7	9	10	5	7	8	5
CONTROL TOTAL		51	57	58	53	54	60	50	50
WHITE TOTAL		54	52	58	61	56	54	58	58
BLUE TOTAL		43	34	33	33	36	30	39	39
RED TOTAL		24	26	25	23	26	27	26	26
CONTROL MEAN		4.64	5.18	5.27	4.82	4.91	5.45	4.55	4.55
WHITE MEAN		5.40	5.20	5.80	6.10	5.60	5.40	5.80	5.80
BLUE MEAN		7.17	5.67	5.50	5.50	6.00	5.00	6.50	6.50
RED MEAN		4.80	5.20	5.00	4.60	5.20	5.40	5.20	5.20

**SUBSTITUTE SHEET**

- 26 -

		DIVISION OF EGGS PER GROUP PER DAY						SUMMARY	
UNIT	TYPE / UNIT NO.	01/04	02/04	03/04	04/04	05/04	06/04	07/04	
CONTROL	1	5	6	4	5	3	8	6	5.00
WHITE	2	8	4	4	4	4	5	5	5.07
RED	3	6	3	5	8	5	5	6	4.71
CONTROL	4	5	6	3	5	7	7	4	5.57
WHITE	5	4	4	6	2	3	3	5	4.00
BLUE	6	4	5	5	8	4	4	5	5.64
CONTROL	7	5	5	3	3	3	7	3	3.50
WHITE	8	6	4	5	2	6	6	4	4.79
BLUE	9	5	4	8	3	4	4	4	4.00
CONTROL	10	4	1	9	6	4	3	3	3.64
WHITE	11	2	2	0	6	7	7	5	6.43
RED	12	2	2	5	7	7	7	5	2.79
CONTROL	13	6	5	4	5	7	7	5	5.50
WHITE	14	5	3	7	7	8	7	6	6.29
BLUE	15	3	6	7	4	2	2	5	5.86
CONTROL	16	2	5	7	7	7	7	5	4.43
WHITE	17	9	6	11	8	8	8	8	7.79
RED	18	7	7	10	4	7	7	7	7.79
BLUE	19	6	10	8	4	6	6	7	5.71
CONTROL	20	"	"	"	"	"	"	"	6.36

- 27 -

DIVISION OF EGGS PER GROUP PER DAY (cont'd)										SUMMARY
UNIT	TYPE	UNIT NO.	01/04	02/04	03/04	04/04	05/04	06/04	07/04	
WHITE	21	6	4	5	6	7	3	6	6	5.07
WHITE	22	5	5	4	2	8	5	8	8	5.36
CONTROL	23	5	4	2	4	5	5	5	3	3.86
BLUE	24	7	6	9	7	7	5	7	7	6.36
WHITE	25	4	9	8	10	13	6	11	11	7.86
CONTROL	26	6	5	3	5	2	6	2	2	4.64
RED	27	6	6	7	5	5	8	7	7	6.14
WHITE	28	6	7	8	6	6	5	7	7	6.29
CONTROL	29	3	4	6	7	3	5	6	6	5.00
RED	30	4	6	6	2	5	8	5	5	4.86
WHITE	31	6	3	9	5	7	4	8	8	6.29
CONTROL	32	8	9	7	7	8	6	5	5	7.21
TOTAL CONTROL		56	55	57	51	56	62	46	46	54.71
TOTAL WHITE		52	56	62	62	63	51	65	65	57.43
TOTAL BLUE		34	35	39	32	41	31	35	35	35.36
TOTAL RED		25	25	30	27	24	31	29	29	26.29
MEAN CONTROL		5.09	5.00	5.18	4.64	5.09	5.64	4.18	4.18	4.97
MEAN WHITE		5.20	5.60	6.20	6.20	6.30	5.10	6.50	6.50	5.74
MEAN BLUE		5.67	5.83	6.50	5.33	6.83	5.17	5.83	5.83	5.89
MEAN RED		5.00	5.00	6.00	5.40	4.80	6.20	5.80	5.80	5.26

SUBSTITUTE SHEET

- 28 -

APPENDIX E

107/04]		UNIT TYPE / FOOD GIVEN / FOOD REMAINING/AVERAGE AMOUNT OF FOOD EATEN BY CHICKENS		
CONTROL	21450	1973	107.02	
WHITE	21450	1913	107.35	
BLUE			21450	2254
RED			21450	1470
				105.47
				109.78

SUBSTITUTE SHEET

- 29 -

## APPENDIX F

## DIVISION OF THE WEIGHT OF EGGS PER GROUP PER DAY

UNIT TYPE / UNIT NO.	27/03	31/03	03/04	07/04	DATE
CONTROL 1	300	275	275	415	
WHITE 2	575	350	275	325	
RED 3	215	375	325	400	
CONTROL 4	575	335	215	275	
WHITE 5	275	325	450	375	
BLUE 6	525	675	375	285	
CONTROL 7	225	125	225	300	
WHITE 8	275	350	385	275	
BLUE 9	425	150	250	275	
CONTROL 10	215	215	400	225	
WHITE 11	325	500	425	500	
RED 12	225	200	275	235	
CONTROL 13	225	275	715	375	
WHITE 14	425	535	425	300	
BLUE 15	285	575	525	385	
CONTROL 16	400	335	525	300	
BLUE 17	450	465	800	600	
RED 18	450	575	575	525	
BLUE 19	350	450	300	500	
CONTROL 20	400	425	425	215	
WHITE 21	475	200	335	425	
WHITE 22	450	485	250	550	
CONTROL 23	200	215	125	200	
BLUE 24	375	625	650	525	
WHITE 25	550	550	550	725	
CONTROL 26	425	475	200	150	
RED 27	575	335	525	485	
WHITE 28	275	335	575	500	
CONTROL 29	450	335	435	450	
RED 30	285	350	450	350	
WHITE 31	400	425	675	575	
CONTROL 32	700	365	500	365	SUMMARY
TOTAL CONTROL	4115	3375	4040	3270	3700
TOTAL WHITE	4025	4055	4345	4550	4244
TOTAL BLUE	2410	2940	2900	2570	2705
TOTAL RED	1750	1835	2150	1995	1933
CONTROL MEAN	70.95	67.50	70.88	71.09	70.10
WHITE MEAN	69.40	69.91	70.08	70.00	69.85
BLUE MEAN	73.03	75.38	74.36	73.43	74.05
RED MEAN	70.00	70.58	71.67	68.79	70.26

- 30 -

APPENDIX G

One Factor ANOVA X<sub>1</sub>:Column 1 Y<sub>2</sub>:Column 3

Comparison: Mean Diff.: Fisher PLSD: Scheffe F-test: Dunnett t:

Group 1 vs. 2	347.367	367.466	1.25	1.937
Group 1 vs. 3	449.167	313.376*	2.874	2.936
Group 1 vs. 4	433.985	307.988*	2.778	2.887
Group 2 vs. 3	101.8	332.386	.131	.627
Group 2 vs. 4	86.618	327.311	.098	.542

\* Significant at 95%

- 31 -

APPENDIX H

One Factor ANOVA X<sub>1</sub>:Column 1 Y<sub>2</sub>:Column 3

Comparison: Mean Diff.: Fisher PLSD: Scheffe F-test: Dunnett t:

Group 1 vs. 2	115.682	231.428	.523	1.022
Group 1 vs. 3	316.545	225.851*	4.109*	2.867
Group 2 vs. 3	200.864	231.428	1.576	1.775

\* Significant at 95%

SUBSTITUTE SHEET

- 32 -

APPENDIX I  
RAW DATA

	% MORTALITY <del>V<sub>1</sub></del>	expt condition <del>X<sub>1</sub></del>	Column 3 initial no of layers	Column 4 final no of layers
1	0	EX	15	15
2	5.900	EX	17	16
3	11.100	EX	18	16
4	11.100	EX	18	16
5	0	EX	18	18
6	0	EX	18	18
7	11.100	EX	18	16
8	5.600	EX	18	17
9	0	EX	11	11
10	0	EX	11	11
11	20.000	EX	10	8
10	0	EX	17	17
13	5.900	EX	17	16
14	11.800	EX	17	15
15	0	EX	18	18
16	5.600	EX	18	17
17	11.100	EX	18	16
18	11.100	EX	18	16
19	5.900	EX	17	16
20	8.300	EX	12	11
21	0	EX	12	12
22	11.100	CON	18	16
23	22.200	CON	18	14
24	11.100	CON	18	16
25	5.600	CON	18	16
26	11.100	CON	18	16
27	11.100	CON	18	16
28	11.100	CON	18	16
29	16.700	CON	18	15
30	18.200	CON	11	9
31	15.400	CON	13	11
32	13.300	CON	15	13
33	6.300	CON	16	15
34	16.700	CON	18	15
35	22.200	CON	18	14
36	16.700	CON	18	15
37	5.600	CON	18	17
38	11.100	CON	18	16
39	11.800	CON	17	15
40	6.300	CON	16	15
41	16.700	CON	12	10
42	0	CON	10	10

- 33 -

One Factor ANOVA X<sub>1</sub>:Column 1 Y<sub>1</sub>:Column 2

Analysis of Variance Table

Source: DF: Sum Squares: Mean Square: F-test:

Between groups	1	439.087	439.087	13.574
Within groups	40	1293.872	32.347	p = 7.0000E-4
Total	41	1732.959		

Model II estimate of between component variance = 406.74

1

One Factor ANOVA X<sub>1</sub>:Column 1 Y<sub>1</sub>:Column 2

Group: Count: Mean: Std. Dev.: Std. Error:

EX	21	5.929	5.715	1.247
CON	21	12.395	5.66	1.235

2

One Factor ANOVA X<sub>1</sub>:Column 1 Y<sub>1</sub>:Column 2

Comparison: Mean Diff.: Fisher LSD: Scheffe F-test: Dunnett t:

EX vs. CON	-6.467	3.548*	13.574*	3.684
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\*Significant at 95%

3

- 34 -

It will be appreciated by persons skilled  
in the art that the present invention is not  
limited to what has been particularly shown and  
described hereinabove. Rather, the scope of the  
present invention is defined only by the claims  
that follow:

- 35 -

C L A I M S

1. A farm animal toy comprising:  
a colored structure suitable for  
stimulating at least one farm animal characterized  
in that the color of the colored structure is  
selected so as to significantly improve at least  
one measure of the output of at least one farm  
animal.
2. A farm animal toy according to claim 1,  
wherein at least one farm animal is a layer and the  
at least one measure of the output of the farm  
animal comprises at least one of the following  
group:  
egg weight;  
egg mass;  
life expectancy; and  
number of eggs laid.
3. A farm animal toy according to claim 1 or  
claim 2, wherein the color of the colored structure  
is selected from among colors well perceived by the  
farm animal.
4. A farm animal toy according to claim 2,  
wherein a substantial portion of the colored  
structure is blue.
- 25 5. A farm animal toy according to claim 4,  
wherein the frame of the colored structure is blue.
6. A farm animal toy according to claim 4 or  
claim 5, wherein the color of at least one portion  
of the colored structure is red.
- 30 7. A farm animal toy according to any of  
claims 4-6, wherein the color of at least one  
portion of the colored structure is white.

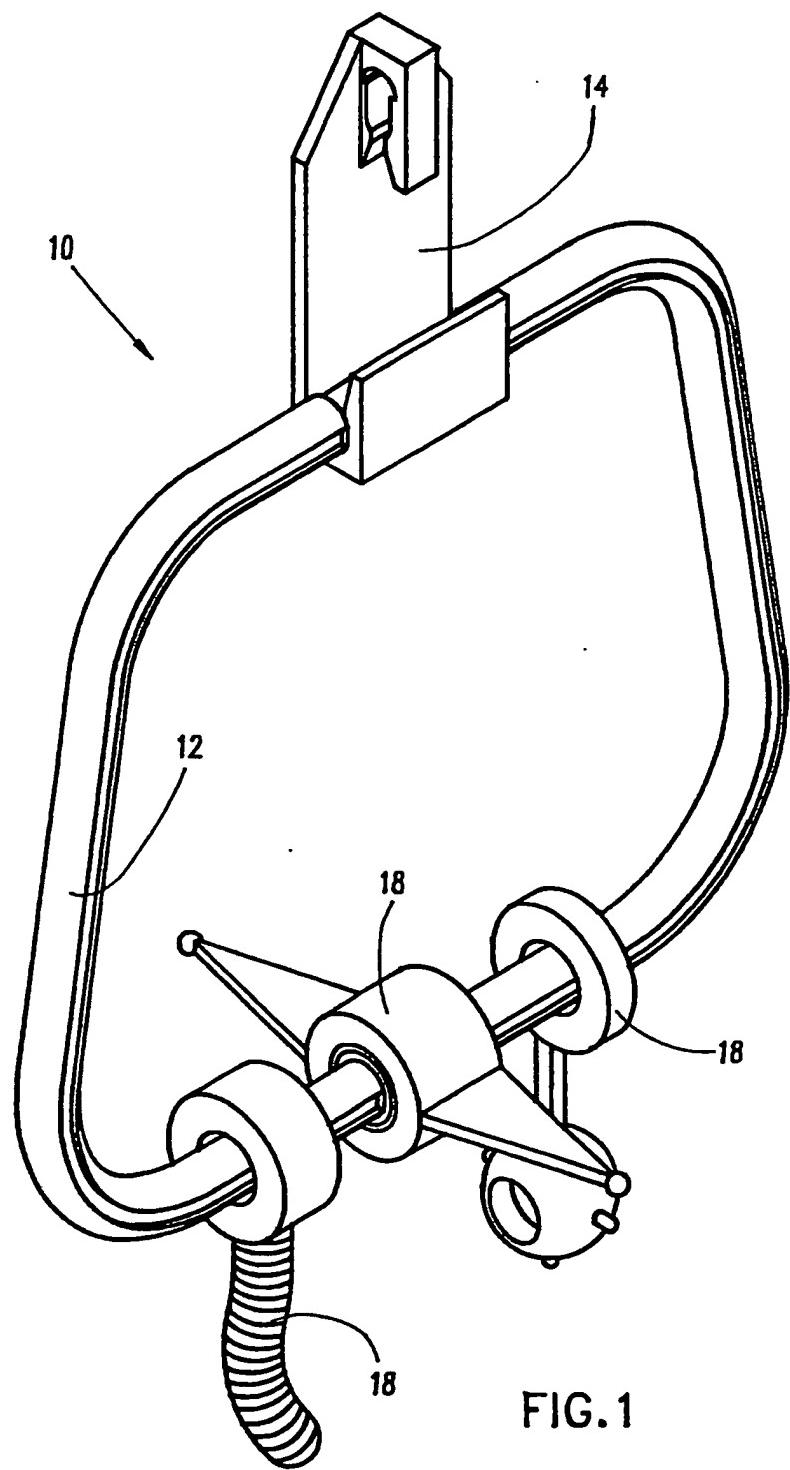


FIG. 1

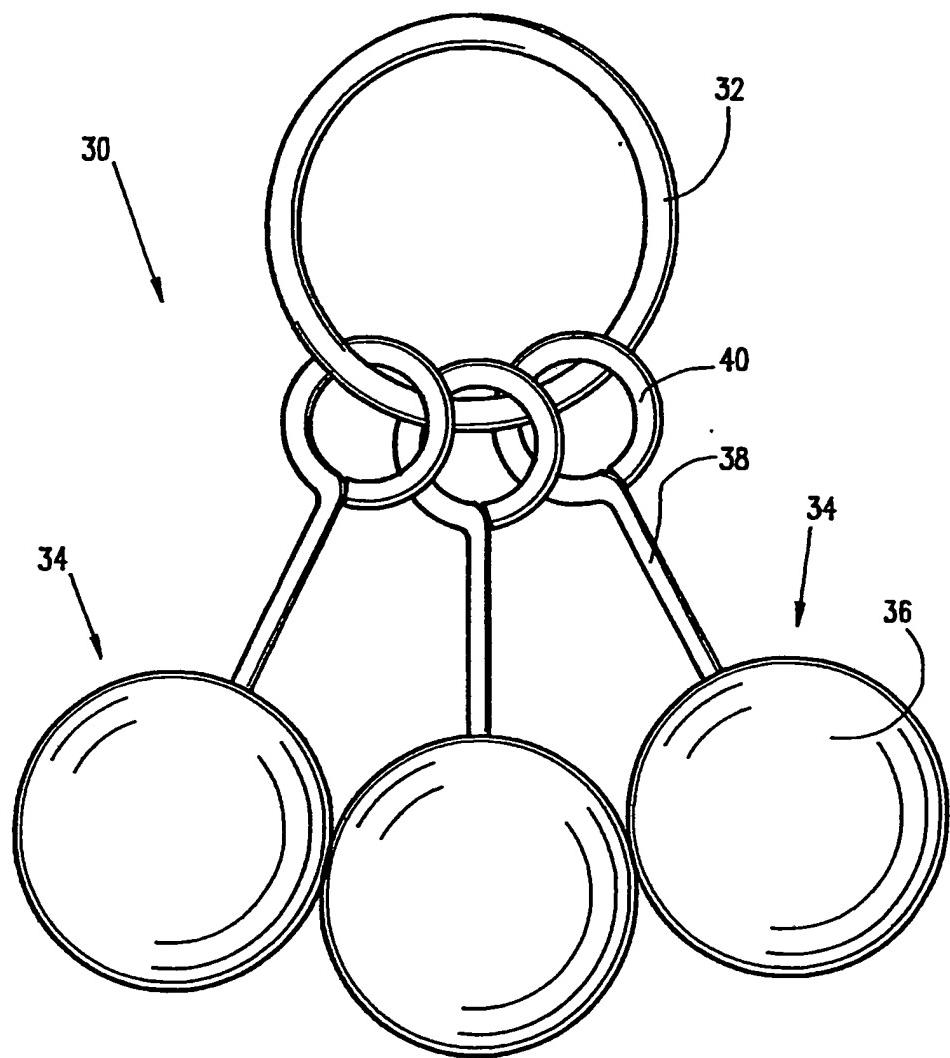


FIG.2

3 / 5

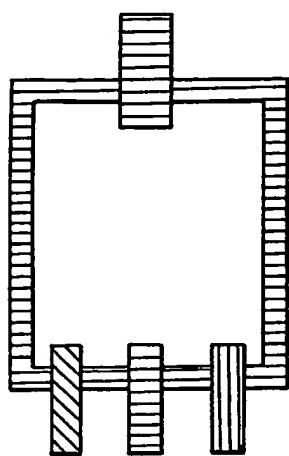


FIG. 3A

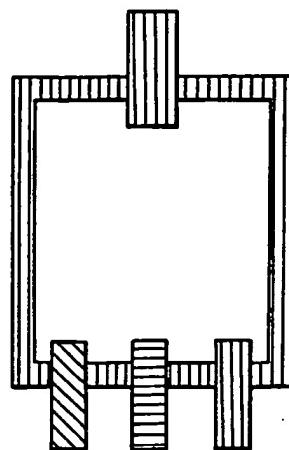


FIG. 3B

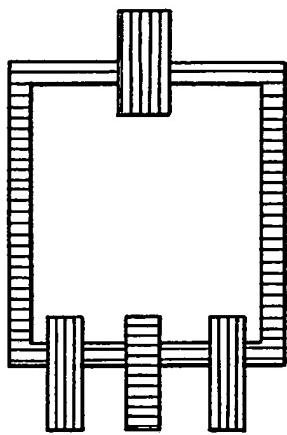


FIG. 4A

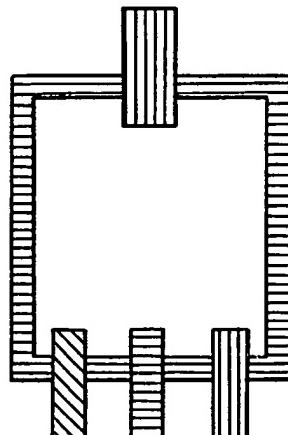


FIG. 4B

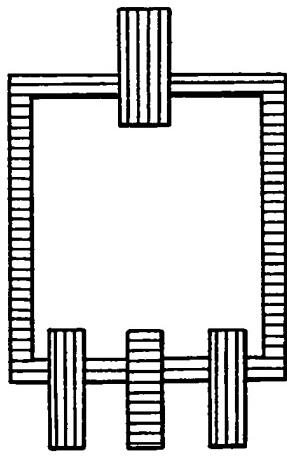


FIG. 5A

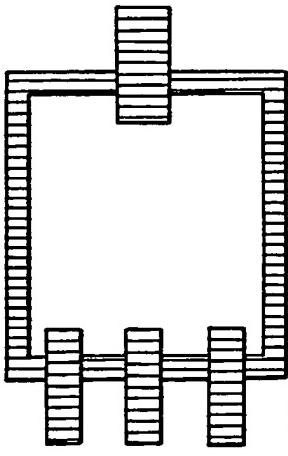


FIG. 5B

4 / 5

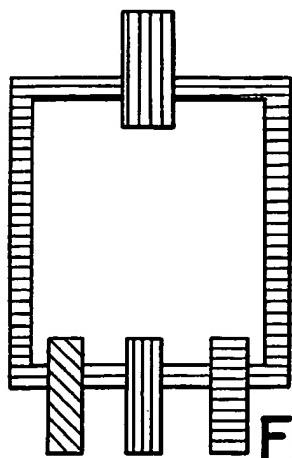


FIG. 6A

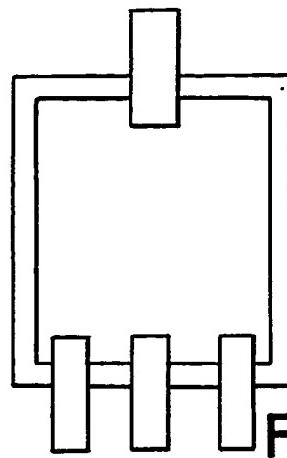


FIG. 6B

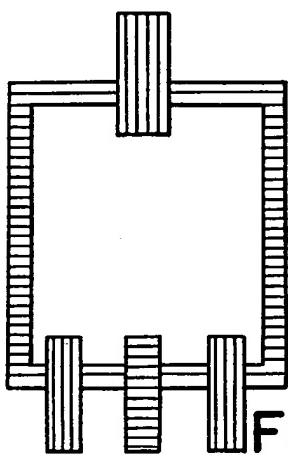


FIG. 7A

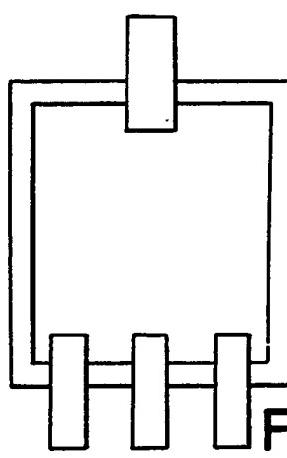


FIG. 7B

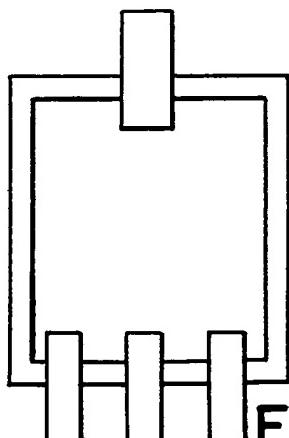


FIG. 8A

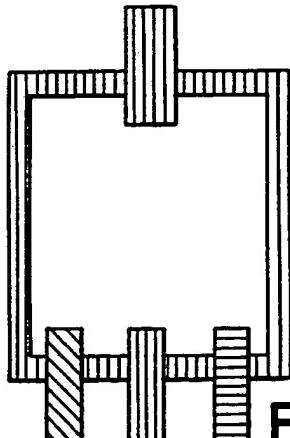
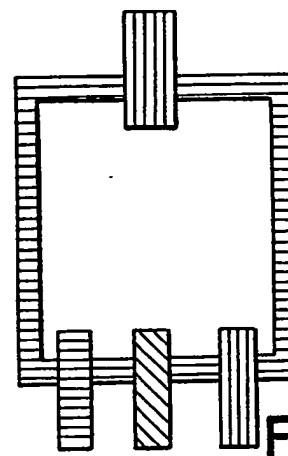
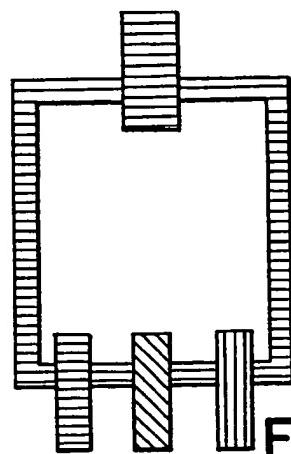


FIG. 8B

5 / 5



SUBSTITUTE SHEET

## INTERNATIONAL SEARCH REPORT

PCT/US92/06492

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(5) :A01K 29/00

US CL :119/29

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 119/29, 6.8, 70, 174, 45.1, 21, 22; 446/227, 491, 419; 606/234, 235

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US, A, 5,010,851 (Gvaryahu et al) 30 April 1991, See column 3, line 37 to column 5, line 18 and claims 1,3, and 7.	1-6 7
X Y	US, A, 4,993,363 (Gvaryahu) 19 February 1991, See column 2, lines 6-42 and claims 5-6.	1-6 7
Y	US, A, 4,542,714 (Ingraham et al) 24 September 1985, See entire document.	1-7
X Y	US, A, 4,913,092 (Gvaryahu et al) 03 April 1990, See column 2, lines 30-49 and claims 1,2 and 5.	1-6 7

Further documents are listed in the continuation of Box C.  See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search  08 JANUARY 1993	Date of mailing of the international search report  19 JAN 1993
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Name and mailing address of the ISA/ Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer  TODD MANAHAN <i>Todd Manahan for</i>
Facsimile No. NOT APPLICABLE	Telephone No. (703) 308-0858

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US92/06492

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB, A, 250,875 (Dawson) 22 April 1926, See page 2, lines 2-5.	1-7
Y	GB, A, 103,141 (Childs) 10 January 1917, See page 2, line 39 to page 3, line 13.	1-7
A	US, A, 4,625,728 (Schonberg) 02 December 1986.	1-7

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